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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/888,261	06/21/2001	Sergey Nikolskiy	18563-003410 AT-00075.1	9129
46718 7590 05/07/2007 TOWNSEND AND TOWNSEND AND CREW, LLP (018563) TWO EMBARCADERO CENTER, EIGHTH FLOOR SAN FRANCISCO, CA 94111-3834			EXAMINER SHARON, AYAL I	
			ART UNIT 2123	PAPER NUMBER
			MAIL DATE 05/07/2007	DELIVERY MODE PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/888,261	NIKOLSKIY ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Ayal I. Sharon	2123	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 28 November 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-15 and 17-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-15 and 17-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 August 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date: _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>9/28/06, 11/28/06, 4/13/07</u> .                              | 6) <input type="checkbox"/> Other: _____                          |

## **DETAILED ACTION**

### ***Introduction***

1. Claims 1-15 and 17-20 of U.S. Application 09/888,261 are currently pending. The application was originally filed on 06/21/2001.
2. Claims 21-44 have been cancelled in Applicant's response filed 12/27/05.

### ***Continued Examination Under 37 CFR 1.114***

3. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/28/06 has been entered.

### ***Claim Interpretations***

4. Examiner interprets the term "compress" according to the definition provided in the Microsoft Press Computer User's Dictionary, © 1998, p.76:

To reduce the size of a set of data, such as a file or a communications message, so that it can be stored in less space or transmitted with less bandwidth.

The definition further recites:

Data can be compressed by removing repeated patterns of bits and replacing them with some form of summary that takes up less space; restoring the repeated patterns decompresses the data.

5. Examiner also notes that by applicant's own admission, "surface fitting" is a form of data compression. Pages 9-10 of the specification of the instant application include the following teachings (emphasis added):

Fig. 4 shows an embodiment of a process for communicating the 3D model of the teeth to the treating professional. Since realistic models have a large volume of data, the storage and transmission of the models can be expensive and time consuming. **To reduce transmission problems arising from the large size of the 3D model, the system compresses the data associated with the model. In the embodiment of Fig. 4, the compression is done by modeling the teeth meshes as a curve network (step 220).** Next, the curve network is transmitted to the treating professional (step 222). The curve network can be sent over a local area network (LAN) or a wide area network (WAN) such as the Internet. At the receiving end, once the curve network is received, the 3D model is reconstructed from the curve network for the treating professional to analyze (step 224).

The curve network generation of step 220 is shown in more detail in Fig. 5. First, the process of Fig. 5 obtains one or more sample points from the meshes of a tooth (step 230). Next, the process computes tangent values for the sample points (step 232). The sample points are converted into u, v-space (step 234). Finally, a grid or curve network is generated that satisfies the points in u, v-space (step 236). **This is done by surface fitting the curve network to the original data.**

... More details on the surface fitting are discussed in pages 101-110 of Alan Watt and Mark Watt, Advanced Animation and Rendering Techniques (Addison-Wesley Publishing Company, Menlo Park, California).

The Watt et al. reference is reference "AT" in the IDS filed on 5/02/2002.

#### **Information Disclosure Statement**

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6. The information disclosure statements (IDS) submitted on 9/28/06, 11/28/06, and 4/13/07 are in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statement has been considered by the Examiner.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. The prior art used for these rejections is as follows:

- a. U.S. Patent 5,975,893 to Chishti et al. ("**Chishti**").
- b. Watt et al., Advanced Animation and Rendering Techniques, © 1992, pp. 101-110. ("**Watt**").

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- c. Yamani, S.M. et al. "A System for Human Jaw Modeling Using Intra-Oral Images". Proc. of the 20<sup>th</sup> Annual Conf. of the IEE Eng'g in Medicine and Biology Society. Nov.1, 1998. Vol.2, pp.563-566. ("Yamani").
- d. Bourke, Paul. "Coordinate System Transformation". June 1996. ("Bourke").

10. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

**11. Claim 1-2, 9-15, 17, and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chishti in view of Watt, and further in view of Bourke, and further in view of Yamani.**

12. In regards to Claim 1, Chishti teaches the following limitations:

*1. A computer-implemented method for generating a computer model of one or more teeth, comprising:*

*receiving as input a digital data set of meshes representing the teeth;*

(See Chishti, especially: col.9, line 43 to col.10, line 7; col.10, line 66 – col.11, line 42)

*generating a function in the curved coordinate system to represent each tooth;*

(See Chishti, especially: col.10, lines 29-41; col.11, lines 39-50: Fig.4A and associated text at col.12, lines 2-3. The teaching in col.10, lines 31-34 is that "individual teeth and other components will be 'cut'".)

However, while Chishti teaches representing "parallel set of digital data set ... at a lower resolution" (See Chishti at col.10, lines 52-56.), Chisti does not expressly teach the following limitations:

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*compressing the digital data set to generate a compressed digital data set, the compressing comprising:*

*selecting a curved coordinate system with mappings to and from a 3D space;*

*and rendering a graphical representation of the teeth using the computer model wherein the rendering comprises rendering the teeth at a selected one of multiple orthodontic-specific viewing angles.*

Watt, on the other hand, teaches the use of “parametric surface fitting” to compress data by representing the data as a set of parameter-defined curves. (see Watt, pp.101-110, especially section 3.7.1 “A B-spline surface fitter”). This corresponds to the claimed “compressing the digital data ...” limitation.

Bourke expressly teaches the use of a “spherical” (also called “polar”) coordinate system in which a 3D coordinate space is defined by the following 3 parameters:  $\phi$ ,  $\theta$ , and  $R$ . Bourke also teaches Cartesian and cylindrical coordinate systems, as well as formulas for converting between the three systems. This corresponds to the “selecting a curved coordinate system ...” limitation.

Moreover, Yamani expressly teaches “rendering a graphical representation of the teeth ...” from different viewing angles (see Yamani, Fig.4).

Chishti and Yamani are analogous art because they both are from the same field of endeavor of 3D computer graphics representation of human anatomy. Watt and Bourke are analogous art to Chishti and Yamani because Watt and Bourke teach the mathematics used in 3D computer graphics representation of human anatomy.

Therefore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to combine the data compression of Watt, the coordinate systems of Bourke, and the different viewing angles of Yamani with the teachings of Chishti, because:

Watt teaches that the advantage of compressing image data is that it reduces the size of a set of data, such as a file or a communications message, so that the data can be stored in less space or transmitted with less bandwidth. (See the definition of "compress" in the Microsoft Press Computer User's Dictionary);

Bourke and Chishti teach that the advantage of selecting a coordinate system is that doing so increases computational efficiency. Bourke expressly teaches that "[t]here are three prevalent coordinate systems for describing geometry in 3[D] space[:] cartesian, cylindrical, and spherical (polar). They all provide a way of uniquely defining any point in 3D." Selecting a polar coordinate system would be the most computationally efficient choice, because Chishti teaches (see col.9, line 60 to col. 10, line 6) that the initial data is acquired from an optical scanner, which usually means a laser that revolves around a fixed point, and produces data with the parameters  $\phi$ ,  $\theta$ , and R. Bourke teaches the formulas for converting such data to other coordinate systems.

Yamani teaches that the advantage of viewing anatomical object (in this case, teeth) from different angles is that "such a model will be a tremendous asset in dental training and teaching." (Yamani, p.564, first paragraph).



Therefore, it would have been obvious to combine Chishti, Watt and Bourke with Yamani to obtain the invention as specified in claim 1.

13. In regards to Claim 2, Chishti teaches the following limitations:

*2. The method of claim 1, further comprising displaying the computer model of the teeth using the function and the coordinate system.*

(See Chishti, especially: col.11, line 58 – col.12, line 8; and Fig.4 and Fig.4A)

14. In regards to Claim 9, Chishti teaches a 3D model of the jaw, including the teeth (col.10, line 66 to col.11, line 3). Chishti also teaches that the user can remove individual teeth, as well as the use of “spline curves” in this operation (col.11, lines 39-50).

However, Chishti does not expressly teach use of the specific coordinate system claimed in the following limitation:

*9. The method of claim 1, wherein the coordinate system is based on equation:*

$$V = P(\varphi, \theta) + R * \text{Direction}(\varphi, \theta)$$

*where V is a corresponding point in three-dimensional (3D) space to  $(\varphi, \theta, r)$ , P and Direction are a vector functions expressed in terms of  $\varphi$  and  $\theta$ .*

Bourke, on the other hand, expressly teaches the use of a “spherical” / “polar” coordinate system in which a 3D coordinate space is defined by the following 3 parameters:  $\varphi$ ,  $\theta$ , and R.

The claimed formula  $\{V = P(\varphi, \theta) + R * \text{Direction}(\varphi, \theta)\}$  is inherent to the spherical coordinate system because it is the representation of a vector in terms of angle  $\{P(\varphi, \theta)\}$  and magnitude  $\{R * \text{Direction}(\varphi, \theta)\}$ .

The motivation for combining the teachings of Chishti, Watt and Bourke are recited in the rejection of claim 1.

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Therefore, it would have been obvious to a person of ordinary skill in the art to modify Chishti and Watt with Bourke to obtain the invention as specified in Claim 9.

15. In regards to Claim 10, Chishti teaches the following limitations:

*10. The method of claim 9, wherein the  $P$  and Direction functions are selected to minimize a deviation between the tooth model and a parametric surface specified by the curved coordinate system and the function.*

Chishti teaches that the parameters of the brace are optimized to fit the teeth as best possible. (See Chishti, especially: col.12, line 28 to col. 13, line 15))

16. In regards to Claim 11,

*11. The method of claim 9, wherein  $P$  and Direction are different for incisors and molars.*

It is inherent that incisors and molars have different locations, and therefore different coordinates, in a visual display of teeth in the mouth.

17. In regards to Claim 12, Chishti does not expressly teach the claimed limitations:

*12. The method of claim 1, further comprising determining a radius value.*

Bourke, on the other hand, expressly teaches the use of a "spherical" / "polar" coordinate system in which a 3D coordinate space is defined by the following 3 parameters:  $\phi$ ,  $\theta$ , and  $R$ . Examiner interprets that " $R$ " corresponds to applicants' claimed "radius".

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Chishti with those of Bourke, because Bourke expressly teaches that "There are three prevalent coordinate

systems for describing geometry in 3 space: cartesian, cylindrical, and spherical (polar)."

18. In regards to Claim 13, Chishti teaches the following limitations:

*13. The method of claim 1, further comprising receiving an instruction from a human user to modify the graphical representation of the teeth and modifying the graphical representation in response to the instruction.*

(See Chishti, especially: col.11, line 58 – col.12, line 8; and Fig.4 and Fig.4A)

19. In regards to Claim 14, Chishti teaches the following limitations:

*14. The method of claim 13, further comprising modifying the selected data set in response to the instruction from the user.*

(See Chishti, especially: col.11, line 58 – col.12, line 8; and Fig.4 and Fig.4A)

20. In regards to Claim 15, Chishti teaches the following limitations:

*15. The method of claim 13, further comprising allowing a human user to select a tooth in the graphical representation and, in response, displaying information about the tooth.*

(See Chishti, especially: col.11, lines 13-15 and lines 58-64)

21. In regards to Claim 17,

*17. The method of claim 13, further comprising providing a user interface through which a human user can provide text-based comments after viewing the graphical representation of the teeth.*

(See Chishti, especially: col.14, lines 16-23)

22. In regards to Claim 19,

*19. The method of claim 1, further comprising delivering data representing positions of the teeth at selected points along treatment paths to an appliance fabrication system for use in fabricating at least one orthodontic appliance structured to move the teeth toward final positions.*

(See Chishti, especially: col.12, line 28 to col.13, line 26)

23. In regards to Claim 20,

*20. The method of claim 1, further comprising detecting teeth collision using the curved coordinate system.*

(See Chishti, especially: col.11, lines 3-21)

**24. Claims 3-8 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chishti in view of Watt, and further in view of Bourke, and further in view of Yamani and further in view of Official Notice.**

25. In regards to Claim 3, neither Chishti, Watt, Bourke, or Yamani expressly teach the following limitations:

*3. The method of claim 1, further comprising storing a compact coordinate system description and the function in a file representing a compressed version of the digital data set.*

The Microsoft Press Computer User's Dictionary, on the other hand, expressly defines the term "compress" as follows:

To reduce the size of a set of data, such as a file or a communications message, so that it can be stored in less space or transmitted with less bandwidth.

Therefore, transmitting files is an intended use of the compression techniques taught in Watt.

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via a network.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti, Watt, Bourke, and Yamani with Official Notice, because doing so would facilitate the sharing of information between different computers.

26. In regards to Claim 4:

*4. The method of claim 3, further comprising transmitting the file to a remote computer.*

The claim is rejected on the same grounds as claim 3.

27. In regards to Claim 5, Chishti teaches the following limitations:

*5. The method of claim 4, further comprising displaying the computer model of the teeth using the function at the remote computer.*

The claim is rejected on the same grounds as claim 3.

28. In regards to Claim 6, Chishti does not expressly teach the following limitation:

*6. The method of claim 4, wherein the file is transmitted over a network.*

The claim is rejected on the same grounds as claim 3.

29. In regards to Claim 7, Chishti teaches the following limitations:

*7. The method of claim 6, wherein the network is a wide area network.*

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via a wide area network (WAN).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

30. In regards to Claim 8, Chishti teaches the following limitations:

*8. The method of claim 6, wherein the network is the Internet.*

Official Notice is given that it was old and well known at the time the invention was made to exchange files between computers via the internet.

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Chishti with Official Notice, because doing so would facilitate the sharing of information between different computers.

31. In regards to Claim 18,

*18. The method of claim 13, wherein rendering the graphical representation comprises downloading data to a remote computer at which a human viewer wishes to view the graphical representation.*

The claim is rejected on the same grounds as claim 8.

### ***Response to Arguments***

#### ***Re: Claim Rejections - 35 USC § 103***

32. Examiner has applied new grounds of rejection in light of Applicants' amendments to the claims. Applicants' arguments in the amendment filed 11/28/2006 are exclusively directed to the newly amended features.

33. Examiner has applied new rejections which render Applicants' arguments moot.

### ***Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a bi-week, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached at (571) 272-3753.

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Any response to this office action should be faxed to (571) 273- 8300, or  
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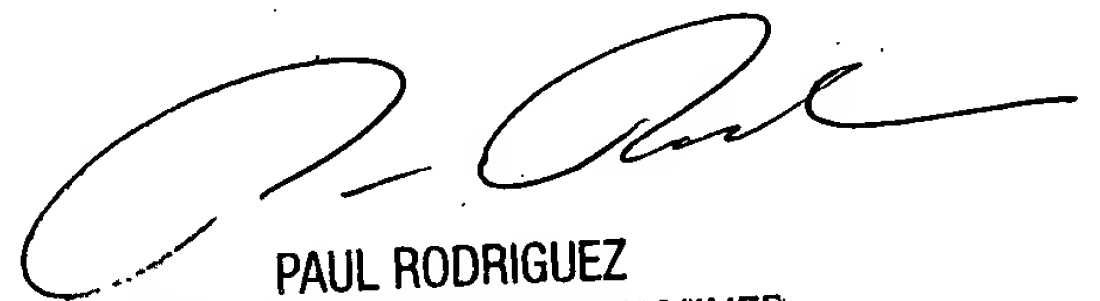
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Any inquiry of a general nature or relating to the status of this application  
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telephone number is (571) 272-2100.

Ayal I. Sharon  
Art Unit 2123  
April 27, 2007



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